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Sea star fertilisation and larval development under in vitro simulated ocean acidification

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Most marine species (ca. 70% of marine invertebrates) have external fertilisation and dispersive larvae that play a key role in marine populations dynamics so understanding the effects of ocean acidification (OA) on marine populations requires knowledge of larval responses. The response of larvae to OA scenarios has mainly been undertaken on calicifying larvae (such as molluscs and echinoderms) with few studies on non-calcifying larvae. Equally important is understanding how high latitude species respond to OA given that polar sea surface waters will be affected earliest (i.e. an undersaturation of calcite and aragonte). We examined responses to OA in the larvae of two species of sea stars, an Antarctic species Odontaster validus and a New Zealand species Pateriella regularis. We examined fertilisation, larval development, morphology and survival in both species when exposed to ambient seawater (pH 8.1 or pH 8.2), to seawater pH predicted for 2100 (pH 7.7 and pH 7.6) and an extreme seawater pH of 7.0, adjusted by bubbling CO_2 gas into filtered seawater. Fertilization in Odontaster validus and Patiriella regularis for the predicted scenarios of seawater pH in 2100 was robust. Larval survival in both species was not significantly reduced when reared at pH 7.8, but mortality increased significantly when pH dropped below 7.6. Normal size and shaped larvae were observed for O. validus and P. regularis reared in pH 7.8 seawater, however pH levels below 7.6 resulted in smaller and under-developed larvae in both species. Overall, this study indicated that sea star reproduction and larval viability was largely uneffected at pH levels predicted for the year 2100, increasing our understanding of the robutness of larvae to pH changes in a lesser studied but important marine group.